BOOK REVIEWS

Controlling Technology: Ethics and the Responsible Engineer, 2nd Edition. Stephen H. Unger. 1994. John Wiley and Sons, Inc., New York, NY. 353 p. $34.95 paper.

Stephen Unger's *Controlling Technology* plays two roles. On one hand, it would serve as a very useful textbook for engineering ethics courses. Unger discusses basic ethical issues, as well as problems which are specific to engineering. He uses a number of case studies to illustrate his points and keep the reading interesting. Each chapter includes a clear introduction and a summary of the main points, a set of discussion questions, and a list of notes and sources for further reading. The book ends with a set of appendices, which include the ethical codes of the various engineering societies, and documents from several of the cases he discusses.

However, the book is more than just a textbook in that Unger is also trying to argue for a particular thesis. He notes that engineers are often the best placed to recognize problems, such as inadequate testing or faulty design, with systems under design or development. Engineers have an obligation, he argues, to report such violations to their superiors, and if that doesn't remedy the problem, to make them public. But engineers who have "blown the whistle" on unsafe or inadequately tested technology have been rewarded for their efforts by being fired, blacklisted, and suffering severe financial, personal, and professional setbacks. Engineers, in other words, are often forced to choose between the public interest and their own self interest. Much of *Controlling Technology* is thus devoted to discussion of the various mechanisms which might be instituted to protect engineers who act in the public interest, including various legal and regulatory changes, and changes that corporations might make in their organizational structure and operating procedures. He holds out the most hope for an increased role for the various professional societies. He suggests that the engineering societies play a role in protecting ethical behavior analogous to the role the American Association of University Professors (AAUP) plays in encouraging academic freedom. The AAUP defends academic freedom simply by keeping a list of those institutions which have been found, after careful investigation, to have committed some violation. This is effective simply because the AAUP has a reputation for being careful, and institutions find it professionally embarrassing to be on this list. Unger suggests that if the engineering societies started keeping similar lists of censured companies, the possibility of being publicly censured might serve as a deterrent to prevent companies from mistreating those engineers who attempt to act ethically.

The book is well organized and clearly written. In the first chapter, Unger introduces the problem and gives a couple of examples of successful large-scale engineering projects. This is a nice touch: ethics texts, for obvious reasons, tend to focus on things that have gone wrong, not on those that have gone right. This sometimes leaves students with the feeling that the authors have a distorted and negative view of the field they are writing about. In the second chapter, he runs through a series of cases, intended to illustrate both the consequences to society of engineers who fail to blow the whistle and consequences to engineers who do blow the whistle. This chapter also includes examples of other ethical dilemmas, including whether to pay bribes in order to get contracts, and the difficulties that engineers who have taken on more than their contractual responsibilities have gotten into. Unger also provides a long discussion of an engineer who went to Nicaragua to develop small-scale rural hydroelectric projects and was killed by the Contras, and of several engineers who quit their jobs so as to avoid working on military or nuclear projects. The point of these last examples, presumably, is to emphasize that there are ethical components involved in the decision about the nature of the work one does, as well as in the question of whether it's being done well or badly. However, these examples, although useful for discussion of other ethical obligations faced by engineers, don't fit smoothly into this chapter. It would have been better, I think, to have devoted a separate chapter to these issues. Next, he discusses in some detail some major disasters (Chernobyl, the Challenger, the Titanic, Bhopal), draws some general lessons from them about what's likely to lead to disaster (e.g., greed, incompetence, political pressure, excessive faith in the particular technology), and discusses how engineers might minimize such disasters (by designing in such a way that simple errors don't have devastating consequences, for example). His suggestions are sensible. In the fourth chapter, he presents a suggested code of engineering ethics. The principle behind the code is that ethical codes must be detailed enough so as to actually provide some guidance in particular situations but not be so detailed as to attempt to cover every possible eventuality. Furthermore, an ethical code must not be so vague as to be empty, but on the other hand must be acceptable to engineers of widely different ethical backgrounds, religious convictions, etc. He attempts to satisfy these demands by finding some general ethical principles which he thinks most people can agree with, and devising the code to respect these principles. He also includes some discussion of the point of having an ethics code at all. In the next several chapters, he discusses the various mechanisms which might be used to assist engineers in acting ethically. He also provides some practical advice for an engineer confronting an ethical conflict about what approaches he should take to management, and how to decide if and when to blow the whistle.

Controlling Technology is a very useful book. It would make a good basic text for engineering courses, as well as useful reading for professional engineers, and anyone else interested in the responsible use of technology.

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Higher Superstition: The Academic Left and its Quarrels with Science. Paul R. Gross and Norman Levitt. 1994. The Johns Hopkins University Press, Baltimore, MD. 328 p. $25.95 hardcover.

This book was written in response to the criticism, among others, by some leftists in academic institutions that "Western science is in fundamental ways blind or blinkered, that it is corrupted by its subtle bigotry and its servile accommodation of power, that it is the artifact of a worldview liable, any day now, to be overthrown." It is the authors' contention that this criticism, although largely promulgated within the Academy, has deleterious effects upon policy and the attitude of the public toward science. The case is made that it is essential to counter this kind of criticism not only because of science's role in advancing the material aspects of our civilization but because it is the strongest and least dispensable ally "of liberatory and democratic ideals."

After a brief discussion of the history of science and its enemies, the authors center their attention upon the "academic left," a diverse group that the authors admit is difficult to characterize because there is no central body of doctrine. The closest intellectual identity it possesses is labeled "perspectivist" and it wishes to strip Western culture of its "claims to universality and timeless, uncontextual validity." According to the perspectivist doctrine, Western culture expresses only local truths or structures that are embedded within specific social experience and political symbology. Alternatively, its authority and hierarchy may be based upon myths but, in either event, the power relations in the societies from which they arise affect them strongly. It follows that the accounts of the world of the disempowered should be "taken as seriously as that of the standard culture."

Much of the rest of the book is devoted to analyzing the several different groups whose separate approaches cohere in their virulent antiscientism and the relativism inherent in the perspectivist doctrine. The first of these considered is the cultural constructivists. Clearly, science is a cultural construct to the extent that the needs of our culture are represented in those projects that receive research funding, in the educational and other institutions that depend upon public funding, etc. Moreover, it is also true that cultural perspectives have, on occasion, dictated the choice of research paradigms. However, the authors argue that this type of social constructivism can be accepted, although with some reservations, as being appropriate and usually non-intrusive. However, the "strong form" of social constructivism, they argue, is something else again. The strong form asserts that each culture develops its own type of science which is a set of conventions that are determined by one historical period. Therefore, it is a *discourse* for one "interpretive community," and is not a corpus of knowledge and theory concerning the "real world." The authors point out that this form of argument is used by certain humanists who thereby deny the difference between scientific knowledge and superstition.

Analyses of the publications of radical feminists, ecologists, afrocentrists, AIDS activists and, in a more limited way, radical animal rights activists are provided along with quotations that give the flavor of the arguments these groups adduce. These arguments are considered in the light of the philosophic and scientific issues raised. In the latter case, misunderstandings of chaos theory and other aspects of mathematics, physics, and biology are corrected in an expert and accessible way.

Numerous quotations illuminate the authors' critique and underscore the aggressively antiscientific attitude of the leftist academics considered. That these quotations are taken from published literature and have been written by mature and, in several cases, prestigious academics, supports the alarm expressed by the authors who, rightly, worry about the likelihood that the noxious effects are reaching students at several levels of our educational system.

Although this book is praiseworthy in most respects, it suffers from some redundancy, especially in the number of quotations. The quotations are apt but the pungency of the critique sometimes is weakened by overlong extension of certain arguments, as in the sections on radical humanists and feminists. In addition, I believe that the authors overstate their scorn of interdisciplinary programs such as Women's Studies and others. There are, of course, weak ones of these that help make the case against the academic antiscientists. However, there are many others that serve distinguishedly, and often temporarily, as a means of enriching research and the curriculum through opening possibilities for experimentation in an otherwise unwieldy system.

Nevertheless, the authors make a strong—and literate—case for the need to address the mischievous and destructive antiscientism of some in the Academy. They have precisely defined and analyzed serious deformities in certain fields of scholarship and, in general, have maintained a fair-minded and generous approach to a literature replete with invective and hyperbole. The references alone provide a useful resource for those interested in pursuing further the subject matter of this book while attesting to the large and diverse literature covered. Whether the authors' recommendations for coping with the difficulties identified will work depends upon the vigor and intelligence of the counterattack, and this book will help address the latter difficulty at least. That it has taken so long for an intellectual focus on this problem to become available attests to the unwillingness of many faculty members to criticize colleagues and to the hitherto inchoate state of our understanding of the problem. We have the authors to thank for overcoming the latter difficulty in an authoritative and readable way.

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Frontiers of Scientific Visualization. Edited by Clifford A. Pickover and Stuart K. Tewksbury. 1994. John Wiley and Sons, Inc., New York, NY. 284 p. $34.95 paper.

This collection of papers, on different aspects of a very new, very hot area of science, computing, and geometry, contains: "Scientific Visualization of Fluid Flow," by H. Aref, R. D. Charles, and T. T. Elvins; "Visualization of

Scroll Waves," by M. Markus and M. Krafczyk; "Visualization of Chemical Gradients," by T. Plesser, W. Kramarczyk, and S. C. Müeller; "Visualization of Biological Information Encoded in DNA," by E. Hamori; "Visualizing Droplet Coalescence Phenomena," by P. Meakin, C. A. Pickover, and F. Family; "Computer Simulation of Plant Growth," by P. de Reffye; "Scientific Display: A Means of Reconciling Scientists and Artists," by J.-F. Colonna; "Architecture and Applications of the Pixel Machine," by M. Potmesil and E. M. Hoffert; and "Brave New Virtual Worlds," by D. M. Weimer.

The reader will not be disappointed by the stunning display of monochrome and colored pictures—computer-generated images combining the skillful communication of large amounts of information with an elegance engaging and pleasing to the eye.

Visualized data can be two-, three-, or even more-dimensional. It can display actual spatial arrangement of geometric objects—points, curves, or surfaces—or the spatial distribution of other data, such as temperatures, flows, or gradients; or it can use all spatial coordinates to represent entirely non-spatial quantities—for example, reaction velocity versus temperature and pressure. Not only can geometric form be used, but grey, shading, color (hue and saturation), texture, real or artificial lighting, line (texture and thickness), and discrete symbols can all be enlisted to enrich the representation of complex data. Almost every aspect of this art is touched on by the versatile and talented authors enlisted by the editors (themselves leaders in the field).

It is sad that we cannot have timely, carefully thought-out treatises, presenting unified, didactically organized, maturely balanced descriptions of such important developments as scientific visualization; but the rapidity of progress in such fields and the need for up-to-date surveys at short notice almost precludes it. This collection of papers by experienced and knowledgeable specialists is the next-best thing, and the interested reader can form a balanced and extended view of this evolving area of endeavor.

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Climate-Biosphere Interactions: Biogenic Emissions and Environmental Effects of Climate Change. Edited by Richard G. Zepp. 1994. John Wiley and Sons, Inc., New York, NY. 303 p. $95.00 hardcover.

A reader who chooses this book by its title is surprised to find that half of the sixteen chapters deal directly with climate change or rice agriculture in China. However, the principles and approaches to the research described in this book provide the reader with a general understanding of the complex interactions among climate, agriculture, and soils.

This volume in the Wiley-Interscience Series on Environmental Science and Technology is a very useful and well-packaged collection of recent research on gaseous emissions from tropical agriculture and biomass burning. Several chapters describe gas exchanges at the tropical soil-air interface before and after forest removal and in various forms of tropical agriculture. The longest chapter, a spatial analysis of land cover changes in Brazil, makes an excellent companion for any discussion of tropical deforestation, a topic that seems to arise in many university courses these days. Middle and high latitude biomass burning is mentioned only briefly so this volume must be considered a primer on climate-biosphere interactions of the tropics.

Contributors to the volume avoided the catastrophe mode when describing the outcomes of biomass removal and climate change, a relief from the gloom-and-doom so common in publications on this topic. Instead, potential results of climate-biosphere change are described with sources of error and uncertainties noted. Gaps in our knowledge of climate modeling, tropical ecology, biogeochemical cycling, and agricultural practices are described with suggestions given for closing the gaps.

The weakest portion of the book is the first three chapters dealing with climate change in China. Inconsistencies and occasional errors in text and diagrams mar these chapters, but a more fundamental problem is use of climate data that are so unreliable that any conclusions are highly suspect. The numerous social upheavals in China this century made it impossible to collect and archive a long series of climate data. Climate data were standardized in China only after 1951 and, as one author noted (p. 32), climate data prior to 1950 were "rearranged" in 1954. The accuracy of the rearranged data is uncertain.

Contributors to the book come from China, the United States, Philippines, and Russia and are an effective mix of scientists from universities, federal agencies, and research institutes. References to other works are modern and thorough. This volume is a good reference book on tropical biogenic emissions and would be useful as a supplementary text in upper level university courses in biology, chemistry, geography, or environmental science.

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Anticancer Drugs from Animals, Plants, and Microorganisms. George R. Petit, Fiona Hogan Pierson, and Cherry L. Herald. 1994. John Wiley and Sons, Inc., New York, NY. 670 p. $89.95 cloth.

The book is a well-organized, extensively cross-referenced compendium of compounds that may act as anticancer drugs which are derived from animals, plants, and microorganisms. The first chapter provides a brief overview of viral diseases, focusing on those that are lethal, such as HIV and ebola, and those that induce tumors. The chapter is concluded by a list of antiviral agents currently used and those that are under investigation as promising new structural leads for development of new antiviral drugs. This serves as a solid introduction to the major types of antiviral agents used today.

Chapter 2 contains a brief description of types of environmental exposures that act as carcinogens, such as irradiation after nuclear weapons testing, x-irradiation

therapy given after surgery or chemotherapy for solid tumors, exposure to ultraviolet light or strong magnetic fields. This is followed by a comprehensive list of synthetic carcinogens, carcinogenic antitumor drugs, naturally occurring carcinogens, types of carcinogenic irradiation, synthetic and naturally occurring tumor promoters, and defines the animal system used to determine their activity. This information is cross-referenced with the pertinent literature citations. This chapter serves as an excellent resource for investigators in the field of cancer research interested in model systems used to examine carcinogenesis and tumor promotion.

Chapter 3 is a tabular survey of all animal and plant antineoplastic or growth inhibitory constituents recorded in the scientific literature from January 1986 through January 1989. The remaining chapters are divided into three sections. Section A (Chapters 4-12) provides a comprehensive listing of new biosynthetic antineoplastic and/or cell growth inhibitory agents. Section B (Chapters 13-19) and Section C (Chapter 20) include a listing of marine animal biosynthetic products and marine plant biosynthetic products, respectively, and their associated chemical structures. Information in Sections B and C includes the organisms from which the products originate, their physical location and chemical/spectral data available for each compound. Each of the compounds in the individual sections is cross referenced with appropriate literature citations. The book concludes with a subject index, listing of molecular weights of the individual compounds, and alphabetical bibliography that corresponds to the references provided in each of the chapters.

In summary, this volume serves as a useful resource for investigators interested in compounds that may prove useful as antineoplastic, anti-promoters, or cytotoxic agents, and for those individuals who require details of their chemical structures and associated biological activities.

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